Cabbage

1. **Make a list of cruciferous vegetables that you eat and those you would like to try. What phytochemicals do they contain? What health benefits do these provide to your body? Develop a list of snack suggestions that include cruciferous vegetables and share with your classmates.**

   Primary/Secondary-level response:
   Answers will vary.

   - A phytochemical is a natural bioactive compound found in plant foods that works with nutrients and dietary fiber to protect the body against disease.
   - Phytochemicals can have complementary and overlapping mechanisms of action in the body, including:
     - antioxidant effects,
     - modulation of detoxification enzymes,
     - stimulation of the immune system,
     - modulation of hormone metabolism, and
     - antibacterial and antiviral effects.
   - Research suggests that phytochemicals, working together with nutrients found in fruits, vegetables and nuts, may help slow the aging process and reduce the risk of many diseases, including:
     - cancer,
     - heart disease,
     - stroke,
     - high blood pressure,
     - cataracts,
     - osteoporosis, and
     - urinary tract infections.

Vegetable:	Phytochemicals found in vegetable:
Bok Choy	Sulphoraphane, indoles
Broccoli	Beta-carotene, lutein, quercetins, sulphoraphane, indoles
Broccoli sprouts	Sulphoraphane
Brussel sprouts	Sulphoraphane, indoles

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Cabbage	Sulphoraphane, indoles
Cauliflower	Sulphoraphane, indoles
Collard greens	Lutein, sulphoraphane, indoles
Kale	Beta-carotene, lutein, quercetins, sulphoraphane, indoles
Swiss chard	Lutein, sulphoraphane, indoles
Turnips	Sulphoraphane, indoles

2. **Fruits and vegetables provide different nutrients and phytochemicals based on what color they are. Research nutrients in different cruciferous vegetables. How do the nutrients differ based on what color the produce is? Look for recipes you can prepare at home that include cruciferous vegetables.**

   Primary/Secondary-level response:
   Answers will vary.

   [Students can view the California Department of Education's nutrient graphs at www.harvestofthemonth.com/EdCorner/nutrient-graphs.asp for a variety of cruciferous vegetables, such as bok choy, broccoli, cabbage, Chinese cabbage, collard greens, and kale. They can use the nutrient graphs to compare and contrast the various levels of nutrients among cruciferous vegetables. Some conclusions they may make might include: variations in colors result in varying levels of nutrients even among plants in same species (i.e., cabbage family); greens tend to have high levels of vitamin A; most varieties are good to excellent sources of vitamin A and vitamin C; and all varieties provide fiber.]

   [Students can look for recipes with cruciferous vegetables at a variety of websites, like:]
   - *Network for a Healthy California* Champions for Change: http://cachampionsforchange.net/en/Recipes.php
   - *Network for a Healthy California Children's Power Play! Campaign:* www.cdph.ca.gov/programs/cpns/Pages/Recipes.aspx

3. **Purple and red cabbages contain anthocyanins. What are anthocyanins and what do they appear to do for the mind and body? Identify other fruits and vegetables that contain anthocyanins and develop a plan to try at least one in the next week.**

   Primary-level response:
   Anthocyanins are the reddish colors found in many fruits, such as strawberries, cherries, cranberries, raspberries, blueberries, grapes, and black currants. They may provide protection against heart disease and certain cancers.

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Foods	Anthocyanin (in mg per 100 grams/food)
aubergine (egg plant)	750
black currant	130-400
blackberry	83-326
blueberry	25-497
cherry	350-400
chokeberry	200-1000
cranberry	60-200
elderberry	450
orange	~200
radish	11-60
raspberry	10-60
red currant	80-420
red grape	30-750
red onions	7-21
red wine	24-35
strawberry	15-35

Source: www.food-info.net/uk/colour/anthocyanin.htm

Secondary-level response:
Anthocyanins are water soluble, reddish pigments found in many fruits, such as strawberries, cherries, cranberries, raspberries, blueberries, grapes, and black currants. Anthocyanins inhibit cholesterol synthesis, provide antioxidant cell protection, and may

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help prevent binding of carcinogens to DNA. They may provide protection against heart disease and certain cancers.

See chart above for examples of fruits and vegetables that contain anthocyanins.

4. **What effect does cooking have on phytochemicals in cruciferous vegetables? What is the best way to consume cabbage to get the most phytochemicals?**

Primary-level response:
Boiling cruciferous vegetables causes some of the phytochemicals to be lost in the cooking water. Cooking methods that use less water, such as steaming or microwaving, reduce nutrient loss.

Have students view nutrient fact labels for cooked versus raw cabbage at www.harvestofthemonth.com/EdCorner/download/images-graphs/fact-labels/WINTER/Cabbage-Group-NFLabels-2010-04-26.pdf to see variations in nutrient levels. Specifically note changes to the vitamin C levels.

Secondary-level response:
Boiling cruciferous vegetables causes some of the phytochemicals to be leached into the cooking water. Cooking methods that use less water, such as steaming or microwaving, reduce nutrient loss.

Have students view nutrient fact labels for cooked versus raw cabbage at www.harvestofthemonth.com/EdCorner/download/images-graphs/fact-labels/WINTER/Cabbage-Group-NFLabels-2010-04-26.pdf to see variations in nutrient levels. Specifically note changes to the vitamin C levels.

Sources:
www.ers.usda.gov
www.leafy-greens.org/cabbage_family.html
www.food-info.net/uk/colour/anthocyanin.htm
www.harvestofthemonth.com/EdCorner/nutrient-graphs.asp

Updated: April 2011

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